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THE PLANT DISEASE REPORTER

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Division of Mycology and Disease Survey

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THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

DIVISION OF MYCOLOGY AND DISEASE SURVEY

Volume XXIII Number 6

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IN THIS ISSUE

The maps of Dutch elm disease, page 92, are self-explanatory.

The disease of pine trees caused by Sphaeropsis ellisi is widely distributed on several species in the East and Middle West, according to Alma M. Waterman, page 93.

J. G. Leach calls attention to the possibility of tuber diagnosis of bacterial ring rot of potato, page 96.

Reports on the maturity of the apple scab fungus, page 96, are contributed by K. J. Kadow for Delaware, R. S. Kirby for Pennsylvania, W. D. Valleau for Kentucky, and H. W. Anderson for Illinois.

Leaf rust and powdery mildew are appearing early in Virginia this year, on wheat and barley, according to S. A. Wingard, page 97. C. O. Johnston reports that the mild winter has favored overwintering of wheat leaf rust in the southern Plains area, page 98.

S. B. Fenne reports on some plant diseases in Virginia, page 98.

Neil E. Stevens and C. M. Haenseler make the fifth experimental forecast of the incidence of bacterial wilt on sweet corn, page 99.

L. J. Alexander and S. P. Doolittle report what seems to be Australian spotted wilt on greenhouse tomatoes in Ohio, page 105.

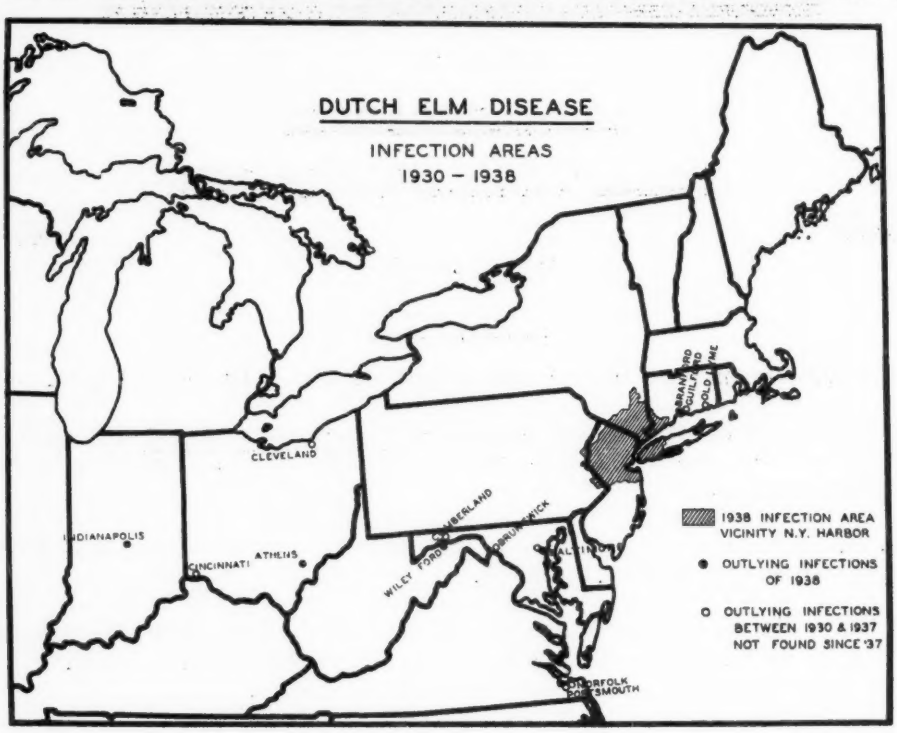
Curly top appeared earlier and was more severe in the Pacific Northwest in 1938 than in the preceding year, according to B. F. Dana, page 107.

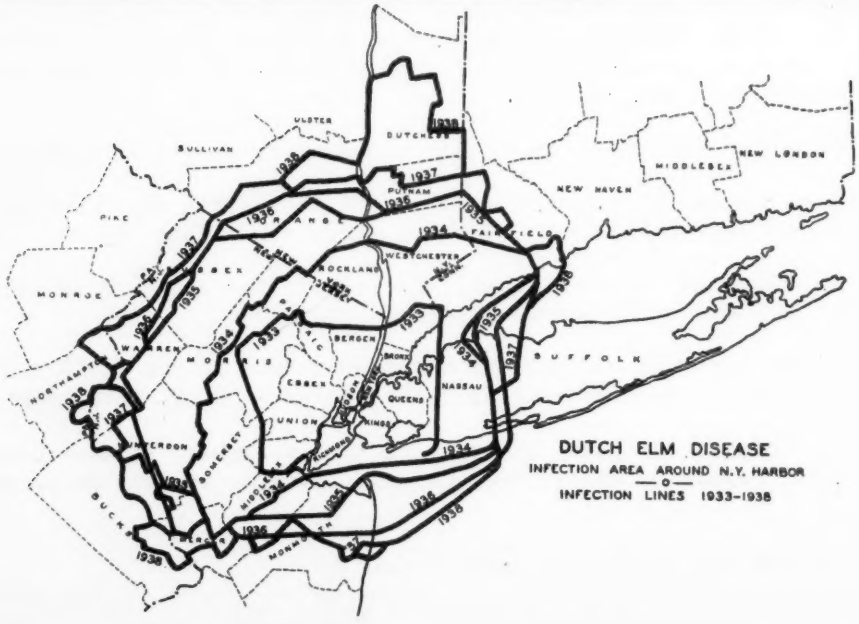
Luther Shaw, W. M. Lunn, and Huey I. Borders report tobacco downy mildew in North Carolina, South Carolina, and Georgia, respectively, page 112.

Winter weather, 1938-1939, page 113.

DUTCH ELM DISEASE IN THE UNITED STATES, 1930 TO 1938

The accompanying maps, furnished by the Bureau of Entomology and Plant Quarantine, show the areas where infected elm trees have been found since the first discovery of Ceratostomella ulmi in this country (upper), and the yearly extent of the disease in the infection area around New York Harbor (lower).





THE DISEASE OF PINES CAUSED BY SPHAEROPSIS ELLISI

Alma M. Waterman

The disease of pines attributed to Sphaeropsis ellisi Sacc. has been under observation for some few years by members of the New Haven Office, Division of Forest Pathology. Austrian pine (Pinus nigra Arn.) has been found to be the most susceptible while other infected species, showing decreasing susceptibility in the order named, are as follows: P. sylvestris Linn., P. resinosa Ait., P. montana Mill., P. ponderosa Dougl., P. strobus Linn., P. virginiana Mill. The determination of the susceptibility of these hosts is based upon observations of infected trees in various localities, information received from owners of infected trees, and also from a limited number of inoculations. One instance of infection has been noted on ornamental trees of Pseudotsuga taxifolia Brit. and Picea pungens Engelm. growing in the vicinity of heavily infected Austrian pines (7).

The disease is widely distributed in the eastern and middle-western sections of the United States. Specimens from trees of the various species of pine used as ornamentals have been received as follows, the number denoting the number of collections from each State:

P. nigra -- Connecticut 3, District of Columbia 3, Iowa 1, Kansas 1, Kentucky 1, Maryland 3, Massachusetts 3, New Hampshire 1, New Jersey 4, New York 15, Ohio 1, Oklahoma 1, Pennsylvania 18, Rhode Island 1, South Dakota 1, Tennessee 1, Wisconsin 1;

P. sylvestris -- Delaware 1, Missouri 1, New Jersey 1, New York 6, Ohio 1, Pennsylvania 4, Rhode Island 2, Wisconsin 2;

P. resinosa -- District of Columbia 1, New Jersey 1, Pennsylvania 2;

P. montana -- Connecticut 1, New York 1, Virginia 1;

P. ponderosa -- New York 1;

P. strobus -- New York 1;

P. virginiana -- Pennsylvania 1.

Observations on the severity of the disease on Austrian pines have been made particularly in eastern Massachusetts, Rhode Island, southern Connecticut, and Pennsylvania in the vicinity of Philadelphia. Usually the progress of the disease is relatively slow on the older ornamental trees, starting on the branches of the lower half of the trees and gradually working upward. At the present time only three cases have been observed where

the disease has entirely killed large Austrian pines. All of these were on neglected estates where the trees had received little or no care. In most cases of serious infection the unsightliness of the trees results in their early removal before they are entirely killed.

On Scotch pine no serious attacks of the disease have been noted in the areas under observation. On red pine in one instance, in Rhode Island, the disease caused some slight injury on the outermost trees of a block planting. Infection has not been considered serious in the East on either Scotch or red pine, except where they are planted among the more susceptible Austrian pine. The same condition has proved true in the case of P. montana and to a less extent for P. ponderosa, P. strobus, and P. virginiana.

In all the cases mentioned the most conspicuous symptoms are the stunting of the new growth and the browning of the needles. Small black pycnidia of the fungus occur at the base of the brown needles, particularly within the leaf sheath. The mycelium grows into the twigs and by late midsummer the pycnidia may be found on the twigs as well as on the needles. The twigs are usually killed back to the first nodes and cankers may be formed around the nodes. In some cases the fungus infects the umbo of the young cone scales on which numerous fruiting bodies are produced, thus becoming an additional source of infection.

The causal organism has been reported in the United States under various names, the earliest reports being as follows: Sphaeropsis pinastri on dead twigs of Pinus sylvestris in New Jersey in 1878 by Cooke and Ellis (type specimen); S. ellisi Sacc. on cones of Pinus nigra, New Jersey, 1894, by Ellis and Everhart; leaves and twigs of P. nigra, Pennsylvania, 1908, (ex herbarium G. G. Hedgcock); leaves and twigs of P. resinosa, New York, 1908 (ex herbarium G. G. Hedgcock); Diplodia megalospora Berk. & Curt. on P. nigra, Illinois, 1883 (ex herbarium A. B. Seymour). In the "Parasitic fungi of New Jersey", published by Schwarze in 1917, it is described as Diplodia pinea (Desm.) Kickx on stems and needles of pine, causing cankers and the dying of needles. Also as D. pinea (Syn. Botryodiplodia pinea (Desm.) Petr.) It is reported as causing a disease of P. insignis, P. montana, P. ponderosa, and P. muricata in South Africa (1), New Zealand (2, 4), Australia (8), Russia (3), and France (6), and of P. nigra and P. sylvestris in Roumania (5).

Positive results have been obtained from inoculations on Pinus nigra, and from cross inoculations on P. sylvestris, P. resinosa, and P. ponderosa with the fungus isolated from needles of P. nigra. Cross inoculations from P. nigra to P. strobus have been negative to date, but only a very limited number have been made.

Control experiments have not been undertaken by the writer. Methods of control have been suggested for infected ornamental trees on private

estates and the results of the tests have been noted. In the fall all infected twigs and needles were pruned out and destroyed. In the spring three applications of 4-4-50 Bordeaux mixture with a soap spreader proved efficient, the first application being made as soon as the new growth started, the second when the needles began to emerge from the leaf sheaths, and the third when the needles were partly grown. During seasons when the weather was particularly favorable for infection or when the new growth was slow in developing, a fourth application was found necessary. This procedure is applicable only to ornamentals and would not be practicable for forest plantings.

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(Division of Forest Pathology, Bureau of Plant Industry, in cooperation with Osborn Botanical Laboratory, Yale University.)

TUBER DIAGNOSIS OF BACTERIAL RING ROT OF POTATOES

J. G. Leach

Dr. R. W. Goss, who has been investigating the occurrence of bacterial ring rot in potatoes from last year's crop stored in bins in Nebraska, points out that diagnosis of the disease in such tubers is relatively easy and suggests that we have probably not put enough emphasis on this method of diagnosis. In most of our correspondence with collaborators we have put the major emphasis on diagnoses made upon plants growing in the field. Perhaps it would be desirable to call attention to the possibility of tuber diagnosis. Dr. Goss points out that the lemon yellow color of infected vascular regions is very distinct and characteristic. The outer cortex often will separate from the inner portion of the tuber along the entire affected portion of the vascular region. In many tubers affected in this way, the pathogen is present in almost pure culture. Gram stains made from these lesions usually demonstrate the presence of gram positive bacteria of the proper size in extremely large numbers. The organism may be isolated in pure culture with very little difficulty when the proper medium is used and sufficient time is allowed for the slow growing pen-point colonies to appear.

(West Virginia University, The College of Agriculture, Forestry, and Home Economics.)

MATURITY OF ASCOSPORES OF THE APPLE SCAB FUNGUS

DELAWARE: We have examined ascospores of the apple scab fungus [Venturia inaequalis] several times. On March 20, the first definitely mature ascospores were seen, although two weeks earlier spores were visible but would not discharge. At this early date the ascospores were hyaline. Perithecia are not difficult to find this year but I have no comments to make as to the number generally present here in Delaware. (K. J. Kadow, March 27. Delaware Agricultural Experiment Station.)

PENNSYLVANIA: An examination of several scab perithecia collected in southeastern Pennsylvania shows that up to March 25 less than 10 percent have brown spores, but it is estimated that at least 1 percent of the perithecia contain scab spores that could start shooting about or slightly before the first of April. (R. S. Kirby, March 27. Pennsylvania State College.)

KENTUCKY: Mature ascospores were found at Princeton February 23, and at Lexington March 21, 1939. (W. D. Valleau. March 21. Kentucky Agricultural Experiment Station.)

ILLINOIS: Apple scab perithecia are very abundant this spring in all orchards examined. The first examination for perithecia was made on February 28 at Urbana. Most showed half-grown asci with no evidence of ascospores. A few showed immature ascospores.

On March 7, at New Burnside in Johnson County (southern Illinois) the spores were differentiated in from 10 to 15 percent of the perithecia. These were mostly hyaline but one or two asci in several perithecia showed brown ascospores which discharged in water.

On March 14, examination of a large number of perithecia at Urbana showed a few with brown ascospores but most had immature ascospores or none yet differentiated. Cold weather from March 15 to March 18 held back further spore development. The Duchess buds were starting to show white tips on March 15 in extreme southern Illinois, but cold weather is now holding them back. The season is at least two weeks behind the abnormally advanced spring of 1938. There is no evidence of peach or apple buds opening at Urbana at this date. (H. W. Anderson, March 18. University of Illinois.)

SOME REPORTS ON DISEASES OF SMALL GRAINS

LEAF RUST AND POWDERY MILDEW OF WHEAT AND BARLEY APPEAR EARLY IN VIRGINIA IN 1939: Leaf rust (Puccinia rubigo-vera) was observed on wheat in Wythe County on March 3, in Roanoke, Appomattox, Powhatan, and Hanover Counties on March 21, and in Shenandoah County on March 23.

Powdery mildew (Erysiphe graminis) was observed on wheat in Montgomery County on March 17, on barley in Powhatan County on March 21, on barley in Frederick County on March 23, and on wheat in Shenandoah County on March 23.

Leaf rust (Puccinia anomala) was observed on barley in Powhatan County on March 21, and in Frederick County on March 23.

These appear to be the earliest dates on record for the appearance of leaf rust and powdery mildew of wheat and barley in Virginia.

The grain in a number of other fields in several other counties was inspected on a trip from Blacksburg to Washington by way of Richmond and return by way of Winchester, but leaf rust and powdery mildew were not observed. Infection was present only on the most advanced grain which was about six to eight inches tall. (S. A. Wingard, Virginia Agricultural Experiment Station.)

OVERWINTERING OF LEAF RUST IN SOUTHERN AND CENTRAL PLAINS STATES: Leaf rust was reported from central Texas and from Oklahoma early in February and was found overwintering at Manhattan on February 1 and 15. A second report from Oklahoma on February 15 indicates that considerable leaf rust has overwintered on early-sown wheat in the vicinity of Enid in the north-central part of that State. Apparently the mild winter has favored abundant overwintering of leaf rust in the southern and central plains areas.

The situation differs from 1938, however, in that winter wheat has not made such an abundant top growth this year as it did in February and March of 1938. As a matter of fact, there is little top growth on wheat in most parts of Kansas, many fields being scarcely green at this time. Stands are poor in many localities and wheat plants are poorly rooted on a vast acreage of the western half of Kansas, owing to deficient surface moisture. (C. O. Johnston, March 4. Cereal Courier 31: 14. March 10.)

NOTES ON SOME PLANT DISEASES IN VIRGINIA

S. B. Fenne

During the past four weeks numerous specimens of clover plants affected by the stem rot caused by Sclerotinia trifoliorum have been received by this department from practically every part of the State. While visiting the tobacco counties in southside Virginia, areas of dead plants in clover fields were observed in most of the counties visited. In severe cases as much as 20 percent of the plants have been killed.

Farmers in Caroline County, Virginia, have recently reported greatly reduced yields of sweetpotatoes, tobacco, and clovers. Upon examination of specimens in the field and storage houses, a rather heavy infestation of the root-knot nematode, Heterodera marioni, was found. The disease has forced several growers to discontinue entirely the production of certified sweetpotatoes. It appears as though other growers will be forced to change from the very susceptible variety, Nancy Hall, to a more resistant variety.

(Extension Plant Pathologist.)

FIFTH EXPERIMENTAL FORECAST OF THE INCIDENCE OF BACTERIAL WILT OF SWEET CORN

Neil E. Stevens and C. M. Haenseler

Summary of Conditions in 1938

In her careful summary of the incidence of bacterial wilt of sweet corn in the northeastern States for 1938 (P.D.R. 22: 401-402), Charlotte Elliott confirms the reports of observers in New York State that the disease was very abundant early in the season, but was relatively less severe as the season advanced. She gives a quantitative measure of the relative incidence of the disease late in the season at Arlington Farm, Virginia. From three 130-foot rows of the susceptible Gill Brothers Golden Bantam in the last three plantings, marketable ears were harvested as follows: 128 in 1936, none in 1937, and 66 in 1938.

The reports from two New York counties seem to deserve special mention in relation to the distribution of the disease. In Ulster County no case of the disease was found in 1935 (P.D.R. 19: 287). It was found on only one field in 1936 (P.D.R. 20: 250), and in this there were less than one percent of seriously diseased plants. In 1937, however, it was reported in two fields with percentages of 4.5 and 11 (P.D.R. 21: 302). On July 1, 1938, C. G. Small reported (P.D.R. 22: 278) that the disease was present in most fields in Ulster County where wilt-susceptible varieties were planted. In Rockland County, which throughout this study has furnished perhaps the best index of the fluctuations of the disease in the eastern States, William J. Clark reported that "This disease was practically non-existent during the growing season of 1936", whereas in 1937 there were heavy losses reaching into "the thousands of dollars for the market gardners in Rockland County". In 1938 Clark stated (P.D.R. 22: 241 and 337) that on June 16 the disease was present throughout the County. In some fields there was only a trace, in others as high as 40 percent of the corn was infected. On August 1, he said that although the disease in Rockland County started with a vengeance, for some reason or other it did not continue.

All this correlates very well, perhaps too well, with our forecast (P.D.R. 22: 100) that:

> "Commercially important losses should occur on susceptible varieties from northern Virginia to central New Jersey and possibly Long Island. Losses should be observably less than last year in Rockland County, New York."

In certain States of the corn belt, however, the picture is different. Koehler (P.D.R. 22: 349 and 374) reported a serious outbreak of this

disease on field corn in Illinois, and (P.D.R. 22: 349) called attention to "significant loss in some gardens in early sweet corn at Urbana and in the East St. Louis [Illinois] area." Bulletin 450 of the University of Illinois Experiment Station[1/] contains on pages 232-236 a detailed report of the damage caused by bacterial wilt and diplodia stalk rot in Illinois in 1938. Regarding bacterial wilt it says:

"The damage caused directly by Stewart's disease in field corn in 1938 was, on the whole, no greater than what had occurred in 1932 and 1933, and probably not so great. Certainly the damage to sweet corn was not so great as in the two earlier years. In field corn the infection was confined mainly to the leaves because it did not come early enough to attack the stalks. In regular commercial corn, except in restricted areas, only parts of the leaves were blighted."

Glenn Smith has given the writers the following summary of the situation in Indiana for the season of 1938, which is published here with his permission:

"Bacterial wilt was apparently the worst since the epidemic of 1932-33. South of Indianapolis losses in commercial plantings of susceptible hybrids were severe. The loss probably reached 10 percent in susceptible varieties for the State as a whole. In date of planting experiments at Battleground (near Lafayette), Golden Bantam showed on July 15 in the first planting - 30 percent disease, and in the second planting - 20 percent disease. By the end of the season all plantings were a total loss."

It is thus apparent that in Illinois and Indiana, at least, there was some "build-up" of the disease compared to the previous year, as a result, very likely, of two successive winters with relatively high temperatures.

Limitations of These Experimental Forecasts

While we plan to continue this experiment in forecasting the incidence of bacterial wilt on the basis of winter temperatures it is without any expectation of success comparable to that of the past four seasons. We are well aware that many as yet unrecognized factors may affect the incidence of this disease. Moreover we are unable to secure information on certain points which would seem to be of great importance.

In her summary, Miss Elliott correlates the behavior of bacterial wilt throughout the season with an unusual abundance of the corn flea beetle

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1/ Dungan, G. H., A. L. Lang, J. H. Bigger, Benjamin Koehler, and Oren Bolin. Illinois corn performance tests - 1938. Illinois Agr. Exp. Stat. Bull. 450. 1939.

(Chaetocnema pulicaria) earlier in the season, followed by a noticeable decrease in numbers by the latter part of July. It is entirely probable that forecasts, more reliable than these, might be made for various localities if they could be based in part on surveys of the abundance of this insect early in the spring. These would be still more valuable if supplemented by a knowledge of the extent to which they carry the bacteria causing the disease. Such work as this, however, we are not prepared to undertake.

The distribution of wilt in New Jersey in 1938 also suggested the existence of some wilt-controlling factor other than winter temperatures. While the prevalence of the disease in the State as a whole followed the prediction based on winter temperature data, local distribution of the disease gave evidence of other modifying factors which cannot be evaluated at present.

On the heavier soils of Burlington County, for example, wilt was very severe (50 percent on very susceptible varieties) early in the season while the same varieties planted at the same time, only five to eight miles away, in a very sandy section showed only 1 to 5 percent infection. Flea beetles may have been the modifying factor in this case since careful observation showed that the corn flea beetle populations in the two sections were roughly in proportion to the incidence of wilt. Very few flea beetles occurred on young corn in the sandy wilt-free area while beetles were very abundant early in the season in the section where wilt became very prevalent later in the season.

There is another factor which may well prove to be of great importance in the future behavior of bacterial wilt of corn. The work of Wellhausen[2/], in conjunction with that of McNew[3/], which has recently been confirmed by Lincoln[4/], clearly indicates that the populations of the organism causing this disease (Aplanobacter stewarti), are exceedingly plastic and that up to a certain "point of stability", presumably representing an equilibrium between the parasite and its particular host environment, successive passages through a highly resistant maize host increased the virulence of the initial strain. It appeared also that this increase was brought about more or less gradually and that the point of apparent stability was reached in as few as seven or eight passages.

In recent years Aplanobacter stewarti has been subjected to exactly these conditions on a grand scale. As early as 1935 (P.D.R. 19: 287) hybrid

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2/ Wellhausen, E. J. Effect of the genetic constitution of the host on the virulence of Phytomonas stewarti. Phytopath. 27: 1070-1089. 1937.

3/ McNew, G. L. Isolation of pathogenic variants from pure cultures of Bacterium stewarti. (Abst.) Phytopath. 27: 135. 1937.

4/ Lincoln, Ralph E. Host-parasite interactions with bacterial wilt of maize. Science n. s. 89: 159-160. Feb. 17, 1939.

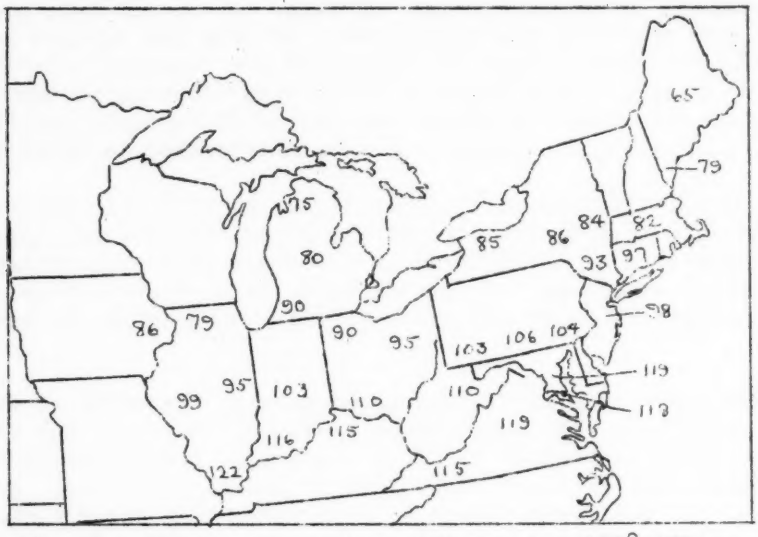

Fig. 1. Winter temperature indices for 1938-1939.

sweet corn had become so popular that it was difficult to find enough plantings of early susceptible varieties to make an adequate survey for the disease in critical areas. In 1936 at least 200,000 acres of Golden Cross Bantam alone were planted (P.D.R. 20: 253). The plantings of this hybrid were close to 250,000 acres in 1938 which is probably about three-fourths of all the yellow sweet corn grown commercially in the United States. Since Golden Cross Bantam first attained popularity because it is decidedly more resistant to bacterial wilt than the open pollinated varieties, this means that in the area in which yellow sweet corn is grown and in which the fluctuation of this disease has been closely watched since 1932, the host environment of this organism has been changed to a very marked degree. In the light of Wellhausen's results it is possible that we are now dealing, or will soon be dealing, with strains of A. stewarti much more virulent than those which caused the epidemic of 1931-33.

We have no intention at present of attempting to extend these forecasts to field corn. Very little is known of the history of the disease in field corn and the situation is complicated by the widespread planting of hybrids of unknown disease record. It may be, however, that the presence of large amounts of the disease on field corn may affect its abundance on sweet corn.

Temperatures of the Past Winter and Forecast for 1939

Temperature indices for the winter of 1938-39 at a number of stations in the northeastern United States are given in Fig. 1. The indices for the

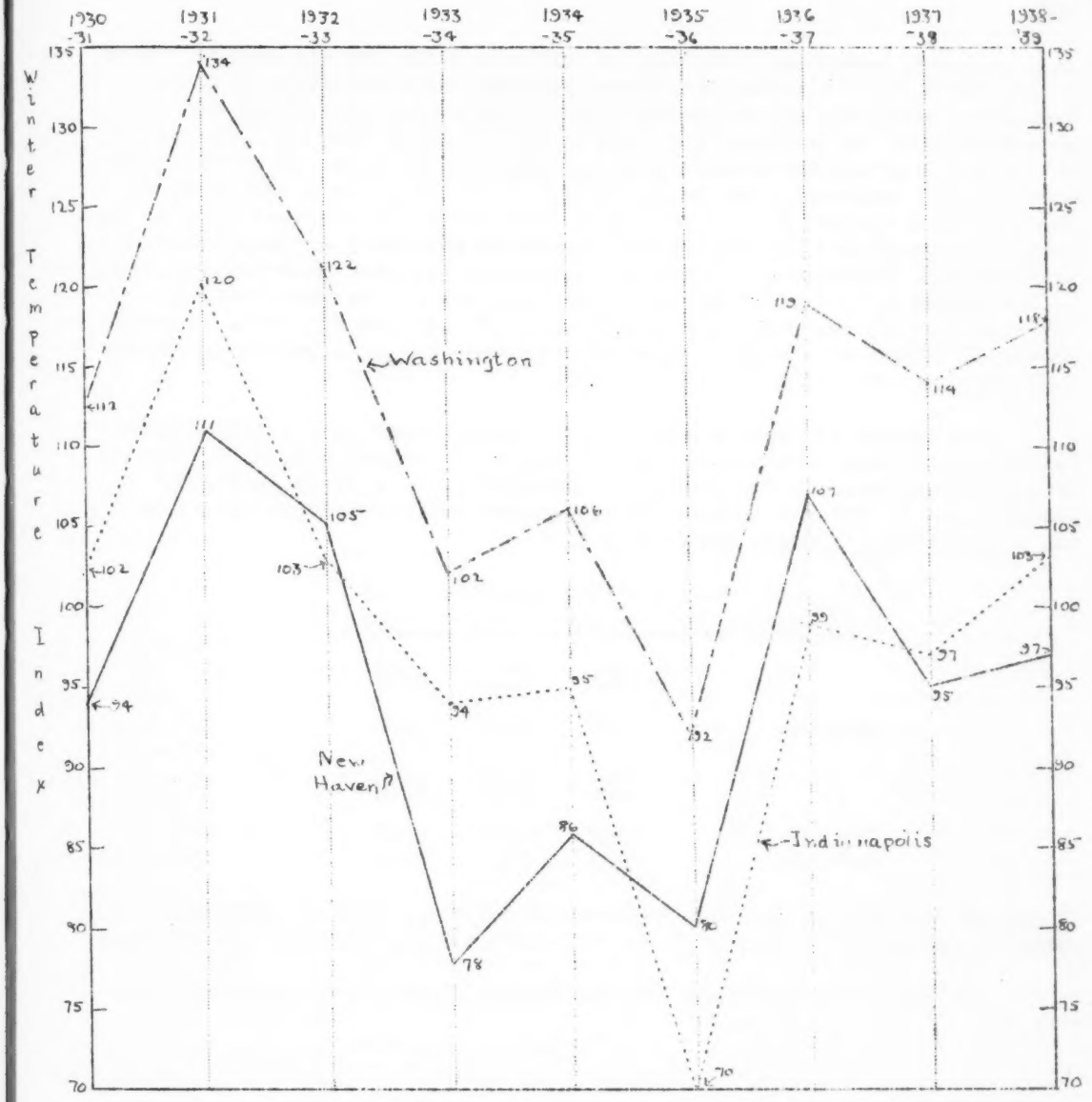

Fig. 2. Temperature indices of recent winters at Indianapolis, Indiana, New Haven, Connecticut, and Washington, D. C.

same stations have been published in previous years and the general trend is indicated by the curves for three representative stations, Fig. 2. Throughout most of the area being studied the winter of 1938-39 was slightly warmer than the previous one, and slightly colder than that of 1936-37. On the basis of winter temperatures as indicated by a sum of monthly means then, if the hypothesis now being tested is correct, there should be at least as much bacterial wilt on susceptible varieties of sweet corn as last year, with commercially significant losses as far north as Rockland County, New York and Indianapolis, Indiana. Reference has been made several times to the probability that a series of warm winters may be more favorable to the disease than one very warm one (P.D.R. 18: 147 and 22: 100). The accumulated effect of the past three warm winters may well result in losses more serious than those of 1937 or 1938.

Any method of representing winter temperatures by a single figure leaves out of consideration the distribution of temperature, which may be of great importance to the organisms concerned. In Indiana last year February was by far the warmest of the winter months, whereas this year it was slightly the coldest. (See table 1.)

Table 1. Mean monthly temperatures at Indianapolis for the last three winters.

	1936	1937	1938
December	35.8	29.5	34.3
	1937	1938	1939
January	33.2	29.4	35.9
February	30.4	37.7	33.2

It may be possible to get some information on what, if any, difference this makes by careful observation in central and southern Indiana this season.

(University of Illinois and New Jersey Agricultural Experiment Station.)

THE OCCURRENCE IN AN OHIO GLASSHOUSE-GROWN CROP OF TOMATOES OF A DISEASE THOUGHT TO BE AUSTRALIAN "SPOTTED WILT"

L. J. Alexander and S. P. Doolittle

A commercial crop of glasshouse tomatoes at Rocky River, Ohio, was visited on November 3, 1938, and found to be severely damaged by a disease of the streak or dieback type. Although the symptoms in some respects were unfamiliar to the authors, they were similar in many ways to those of Australian spotted wilt. The grower stated that the disease had been present from the time the plants were transplanted to the houses during the first week in August. When first visited, the healthy vines had reached the overhead supporting wires and had been topped above the eighth or ninth cluster. At this time the vines were at the peak of production but the crop had been reduced about 50 percent because of injury to the plants and the large number of blemished fruits.

At the time of the first observations a number of plants showed initial symptoms of the disease which consisted of dark brown, necrotic lesions on the younger leaves. In some instances the lesions were small and roughly circular but more often they were irregular in outline. In some cases the leaflets had withered and died but generally only small portions were affected. The stems also showed extensive necrotic streaks which in some instances caused a severe dieback at the growing point. During November and December a considerable number of the most severely affected plants wilted, collapsed, and died. Cross-sections of the stems in such cases showed a slight discoloration of the vascular elements but cultures on potato dextrose agar failed to establish the presence of any pathogenic organism.

Many of the plants that had become infected while small were still living. They were severely stunted; the leaflets curled upwards and were of a dull green or purplish color. Some of these plants had no active growing point, some had formed new growth from an axillary bud, and a few still possessed what appeared to be the original growing point. Some plants showed a certain degree of recovery as evidenced by the production of several laterals.

Fruit borne on infected plants was seldom marketable because of blemishes. Immature fruit usually developed dark brown or black necrotic areas which were variable in size and usually irregular in outline, although some were circular with concentric markings. As the immature fruits enlarged, many small cracks frequently appeared in the necrotic areas. On mature or nearly mature fruit, the discolored areas were frequently ring-shape although often irregular in outline. They were generally a lighter red in color with a distinct yellowish tinge and did not become necrotic as in the immature fruits. When fully ripe such fruits occasionally showed markings almost white in color.

The symptoms of the disease are generally similar to those described by Samuel, Bald, and Pittman[1/] for Australian spotted wilt, although these writers do not report wilting and death of mature plants. The symptoms, however, were essentially similar in all other respects to spotted wilt as described in Australia and as seen by one of the writers in the United States. The killing back of the tips is in some ways suggestive of the tip blight disease of tomatoes reported by Milbrath[2/], but as far as could be determined by observation, it seems more probable that the Ohio virus was that described as spotted wilt. The symptoms were not suggestive of either the "combination" streak (caused by tobacco virus 1 combined with X virus of potato) nor were they characteristic of those of the so-called "glasshouse" or single virus streak. Neither of these diseases cause the death of the plant and after initial infection there is a marked degree of recovery and a partial crop is usually produced. Combination streak spreads rapidly down the row after it once appears, owing to transmission by handling and contact, and the glasshouse streak usually spreads very little after its initial appearance. The disease here described spread slowly in irregular areas and the spread appeared to have been continuous throughout the season. The symptoms on mature fruit were strikingly different from those produced by the virus of the two streaks mentioned since combination streak produces only irregular, brown, necrotic lesions and while the glasshouse streak occasionally produces ring markings, the necrotic areas which develop are always brown in color and never concentric in pattern.

An examination of the house in question showed that one of the vectors of spotted wilt, Thrips tabaci, was present in small numbers. It was found also that the owner was using a portion of the glasshouse during the late winter and early spring for dahlia propagation each year, and that some of these dahlias had previously shown ring spot symptoms similar to those produced by the spotted wilt virus on this host. It is possible that the combination of dahlias and tomatoes in the same greenhouse may explain the development of a type of virus infection which heretofore has not been noted in Ohio.

(Ohio Agricultural Experiment Station and Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, cooperating.)

1/ Samuel, Geoffrey, J. G. Bald, and H. A. Pittman. Investigations on "spotted wilt" of tomatoes. Austral. Counc. Scient. Indust. Res. Bull. 44: 1-64. 1930.

2/ Milbrath, J. A. Tomato tip-blight virus. Phytopath. 29: 156-168. 1939.

OCCURRENCE OF CURLY TOP IN THE PACIFIC NORTHWEST IN 1938

B. F. Dana

The general distribution of curly top in the Pacific Northwest was similar to that of 1937. Severity of infection exceeded that of 1937 and equalled that of 1935 and 1936. Earlier appearance of the disease was responsible for increased losses. The following observations were made during the growing season:

OREGON

Willamette Valley

A trace of curly top was noted in tomatoes in the Salem, Corvallis, and Eugene districts. Leafhopper-vectors must migrate annually from east of the Cascade Mountains to distribute the disease in the Willamette Valley.

Portland Area

Losses were unusually severe in tomatoes. Since infection took place generally before much fruit was picked, crop losses equalled the percentage of plant infection. The virus is introduced by beet leafhoppers migrating down the Columbia River Gorge from breeding grounds east of the Cascades.

August 5, Park Rose, 2 acres tomatoes, 50% curly top, 50% loss.
1/2 acre peppers, 10% curly top, 5% loss.

September 8, Observations on tomatoes in Northeast-Portland Market Garden District:

1/2 acre, 30% curly top
garden, 30% curly top
1/2 acre, 20% curly top
1 acre, 30% curly top
1 acre, 30% curly top
1/2 acre, 20% curly top.

1 acre, 50% curly top
1/2 acre, 30% curly top
1 acre, 10-20% curly top
2 1/2 acres, 60% curly top
2 acres, 60% curly top

Redmond Section

Only tomatoes grown under cloth or lath shelters escaped curly-top infection. Protection of this kind also serves to extend the growing season. Vectors appear to come from nearby breeding grounds. These breeding grounds may also supply vectors to the upper Willamette Valley carried over the Santiam and McKenzie passes by those east winds which coincide with spring movements of leafhoppers from these breeding grounds.

August 27.	Tomato	total loss unless covered
	Table beets (general infection)	loss estimated 10%
	Petunia	seriously injured
	Pansy	seriously injured.

Tygh Valley

August 27.	Tomato	total loss unless covered
	Hubbard squash	total loss
	Cheese pumpkin	tip injury
	Kentucky Field pumpkin	tip injury.

Dufur

August 27. Tomatoes in farm gardens were generally a total loss from curly top unless covered. A cloth-strip row-cover for tomatoes is becoming popular in this section. These are put on at the time of transplanting and removed about the middle of July.

The Dalles Section

This is an early market section where plants are started under glass and transplanted with a relatively large mass of soil. Some are staked and some are grown on racks that hold the plant together and raise it a few inches off the ground. The bulk of the plants are not trained. Fields ranged from one-tenth of an acre to an acre in size. Variation in disease may be due in part to exposure. Wind-break protection appears to reduce infection, especially if plants are shaded part of the day. The following observations were made July 21 which was toward the end of the season in this section.

Tomatoes

Truck farm number	Curly top %	Loss %	Truck farm number	Curly top %	Loss %
1	20	10	5	75	75**
2	90	90*	6	50	50
3	20	20**	7	90	90
4	20	20	8	30	30

(* -- on racks. ** -- staked.)

Milton-Freewater Section

This is also an early market tomato section with plants grown to blossoming size under glass before transplanting. Most of the plants are grown in spruce or pine veneer bands. Observations were made July 25 which was near the end of the growing season for this district, also.

This year 400 acres of tomatoes were grown with 90 percent of the plants developing curly-top infection after a partial crop was harvested. Loss was estimated at 50 percent for this district. Early migration of the leafhopper-vectors into this section increased losses over those experienced in 1937.

Hermiston Section

Experimental plots for vegetable curly-top resistance tests are maintained on the Umatilla Field Station. Interplanting test plots with beets serves to increase vector populations over that in growers' fields. However, curly top was more severe than had been observed for several years. Growers' fields of resistant Marblehead squash exhibited general infection with pronounced witches' broom development late in the season. Tomatoes and garden beans, unless shaded, were a total loss.

Ontario Section

Only a few tomatoes are grown in this district. On September 17 a market garden between Ontario and Nyssa was examined. Tomatoes partly shaded showed 15 to 20 percent curly top with 10 percent loss. Peppers in a more exposed situation showed about the same percent of disease and loss. Resistant sugar beets were grown in this district to supply a sugar factory completed and put into operation this year.

WASHINGTON

Clark County

Woodland District. This section, about 25 miles north of Vancouver, has been of particular interest since it appears to be about the limit of migration of the beet leafhoppers down the Columbia River, using occurrence of curly top in tomato as a criterion. This field was visited October 6 in company with Dr. Glenn A. Huber, Western Washington Experiment Station. In tomatoes transplanted early in the season curly top killed about 35 percent of the plants. Plants transplanted later developed about 10 percent of disease. In this field, which is located on the bank of the Lewis River, some of the plants that became diseased late in the season continued to grow producing witches' brooms and abnormal inflorescences. Growth in tomato in the field following infection is rare.

Walnut Grove District. Dr. Huber reported that on the Olson farm 25 to 30 percent of the tomato plants were affected by curly top.

Puget Sound Area

Dr. Huber of the Western Washington Experiment Station reported that in the Kent area of King County 10 percent of the tomato plants in several plantings were affected with curly top.

Yakima Valley

The bulk of the vegetables produced for market in this section are grown in the area south of Donald and Wapato. The following observations are representative of curly-top losses. Tomato seed is drilled in rows directly in the field because of greater losses to transplanted plants. Even with a high percentage of curly top, fruit was harvested from surviving plants. These were irregularly distributed in the field. Percent of loss estimates are based on yield which might be expected from a normal stand of plants.

September 19-20. Observations in the Yakima Valley.

Location	Acres	Crop	Curly top %	Loss %
South Donald	1	Tomatoes	95	50-60
"	1/8	Peppers	50 (curly top dwarf)	50
Selah	1/4	Tomatoes	80	80
South Donald	1	"	100[a]	30
"	1/2	"	80	60
"	3	"	80-90	75
"	4	"	90	75
Harrah	1	"	70	abandoned for curly top
Wapato	1	"	100[a]	80
"	2	"	90	75
"	1	"	50	50
"	5	"	90-95	75
"	1/8	Peppers	50	50
		Cantaloup	65	[b]
"	1/10	Danish squash	100	100
"	Small patch	Honey Dew	75	75
"	Small patch	Casaba melon		0
"	2	Tomatoes	90	70-75
"	3	"	90[c]	60
"	1	"	80[c]	75
Sunnyside	4	"	90-95	95

[a] Some very late infection involved remainder of producing plants.

[b] Some reduction in yield, and later picked fruits were decidedly inferior in quality because of curly top injury to vines. This field is representative of the general cantaloup situation in the Yakima Valley.

[c] Stand 20% of normal.

Prosser, Small Experimental Plots.

Tomato, transplanted	total loss
Tomato, seeded at time of transplanting other plot	80% stand
Long White Bush vegetable marrow	some injury
Kentucky Field pumpkin	tip injury
Cheese pumpkin	tip injury
Black Zucchini vegetable marrow	only few surviving
Golden Delicious squash	no plants alive
Red Mexican bean	some injury
Wax bean	total loss
Soy bean	minor injury

Kennewick Section

September 20. Tomato seed for commercial acreage is drilled in rows directly in the field. Fields totaling about 10 acres were examined. At least 90 percent of the original plants had beem killed, leaving about 25 percent of a normal stand. Additional loss would be expected before the end of season. No picking has been done at this date. Final loss is estimated at about 90 percent of normal yield. Curly top was more severe than for the average year.

Spokane Valley

Observations were made July 29, 1938. Losses equal the percentage of curly top. Tomatoes were all transplanted.

Acres	Crop	Curly top %	Acres	Crop	Curly top %
1 1/2	Tomatoes	none	1	Tomatoes	60
1	"	50	garden	Peppers	10
1/2	"	75	2	Tomatoes[a]	10-50
1/10	"	80	1/2	"	60
1/2	"	50	1/4	"	50
2	"	40	3	"	50
1	"	60	1/2	"	50
1/2	"	75	1/4	"	50

[a] In orchard.

Lewiston-Clarkston Section

The Clarkston District. Tomatoes are grown generally in garden plots, often protected by trees which lessens injury from curly top over that of market gardens of one-fourth to one and one-half acres. Percentage of loss in tomato fields examined July 26 equalled that of curly top.

Acres	Curly top %	Acres	Curly top %
garden	25	1/2	80
1/4	20	1 1/2	50
garden	25	1 1/2	40
1/5	75	1/4	50

The Lewiston District. General observations in Idaho were not attempted. Observations were made July 26 at Lewiston which correlate with those made in the adjoining Clarkston district. Loss in tomato is estimated to equal the percentage of disease.

Acres	Curly top %	Acres	Curly top %
garden	50	garden	0-5
"	25	"	80
"	100	"	25
"	75	"	50
"	50	1/2	75
"	50	1/2	60
"	0-5		

(Division of Fruit and Vegetable Crops and Diseases.)

FURTHER REPORTS ON TOBACCO DOWNY MILDEW

NORTH CAROLINA: Blue mold [downy mildew caused by Peronospora tabacina] appeared normally in Robeson and Columbus Counties on March 8 on old sites. Since this date the disease has appeared normally on old sites east of Raleigh. Secondary infections are developing slowly because of unusually clear dry weather. The disease is general now only in Robeson and Columbus Counties; elsewhere it is confined to old sites. Injury on old sites is severe in a few cases, otherwise it is negligible. The first general infection period occurred during the last twenty-four hours with general rains. Plants are two weeks behind last year, but about normal. (Luther Shaw, March 30. Extension Plant Pathologist.)

SOUTH CAROLINA: Blue mold is generally distributed throughout the tobacco producing area of South Carolina but development of the disease has been retarded during the past several weeks by clear weather. (W. M. Lunn, Division of Tobacco and Plant Nutrition.)

GEORGIA: A preliminary survey of the blue mold situation in the Georgia flue-cured tobacco area for 1939 indicates that the blue mold epidemic is of moderate severity compared to 1937 as a severe year and 1938

as a light year. Indications are that blue mold did from 40 to 60 percent damage in beds that were not sprayed. Growers who followed the spray recommendations of the Coastal Plain Experiment Station have suffered no appreciable plant loss from blue mold, and, according to present prospects, will have an abundance of plants to set their acreage out on time. Growers who used recommended control measures have, in a number of cases, had sufficient plants left over after setting out to furnish tobacco plants to growers who did not use blue mold control methods. (Huey I. Borders, Extension Plant Pathologist. March 31.)

WINTER WEATHER, 1938-1939

WINTER TEMPERATURE, 1938-1939: Following the general trend in evidence for many years, the temperature for the winter of 1938-39 averaged above normal over much the greater part of the country. December and January averaged generally above normal, the latter being one of the warmest midwinter months of record. However, in February a series of cold polar-air masses moved southwest over the Midwest, and that month was abnormally cold in Central and Western States. However, above-normal warmth continued in the East.

For the winter as a whole Figure 1 shows that the mean temperature was below normal in a considerable far-western area, but was above normal everywhere east of the Rocky Mountains. The largest plus departures appear in the Missouri Valley and from the central Mississippi Valley eastward to the middle Atlantic coast. (U. S. Department of Agriculture Weather Bureau Weekly Weather and Crop Bulletin for the week ending March 14.)

PRECIPITATION, WINTER OF 1938-39: Figure 2 shows the percentage of normal precipitation for the winter, December-February, 1938-39. It indicates that the past winter was unusually wet for the country as a whole as most States had above-normal precipitation, many of them decidedly above normal. East of the Mississippi River only one State, Florida, shows a deficiency. Florida was decidedly dry, with less than two-thirds of normal precipitation. Also the Pacific coast had much less than normal, except the State of Washington; California being the driest, with only 65 percent of normal. The central and southern Rocky Mountains had abundant precipitation, with heavy mountain snowfall in most sections. In the Great Plains the percentage ranged from 80 percent in Montana to 113 percent in Oklahoma. The Lake region and the extreme upper Mississippi Valley had unusually heavy precipitation. (U. S. Department of Agriculture Weather Bureau Weekly Weather and Crop Bulletin for the week ending March 21.)

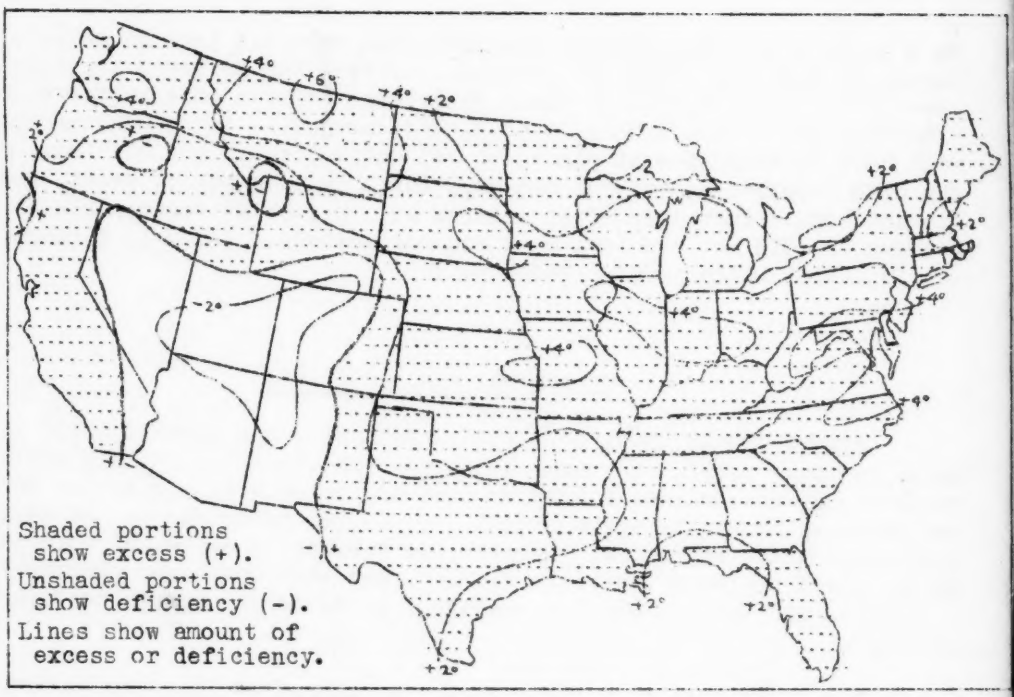

Fig. 1. Departure of Mean Temperature from the Normal for the Winter (December-February), 1938-39.

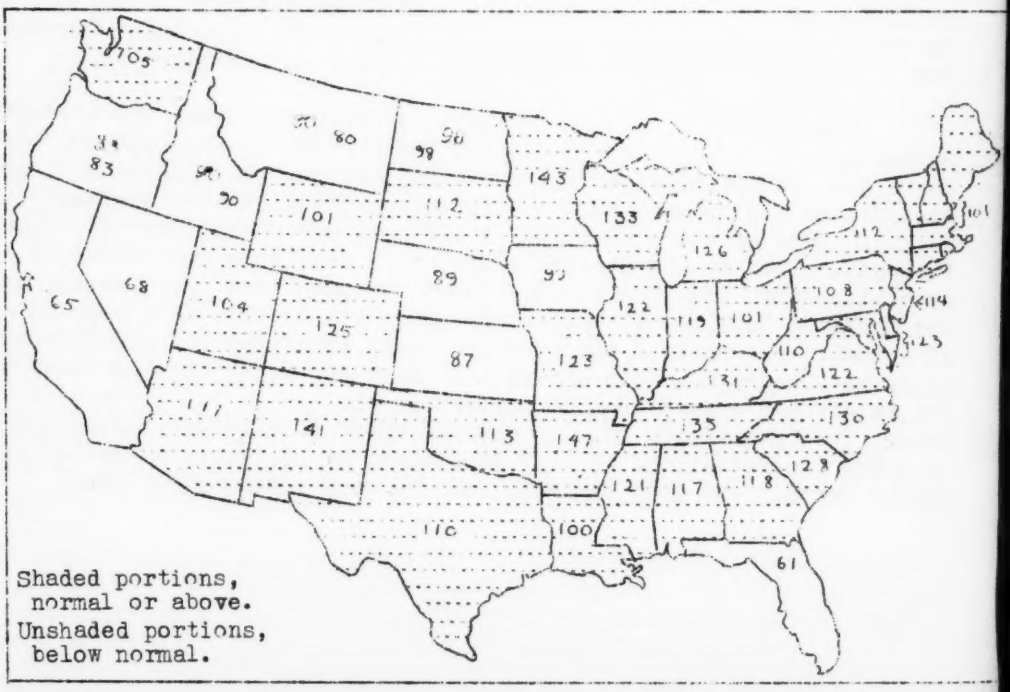

Fig. 2. Percentage of Normal Precipitation, by States, for the Winter (December-February), 1938-39.